National Aeronautics and Space Administration

NASA

EXPLORE EARTH

EARTH SCIENCE TECHNOLOGY FORUM

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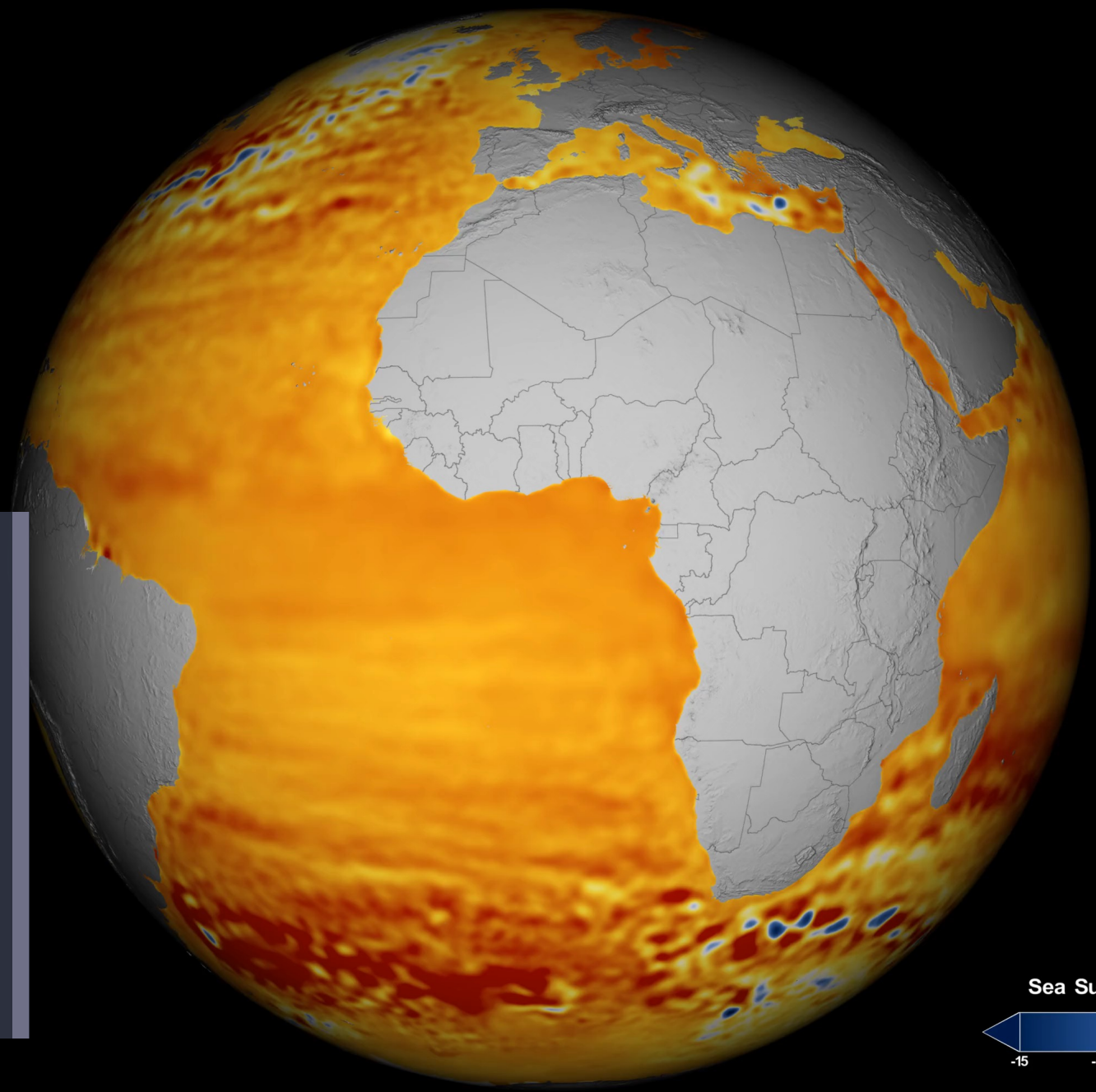
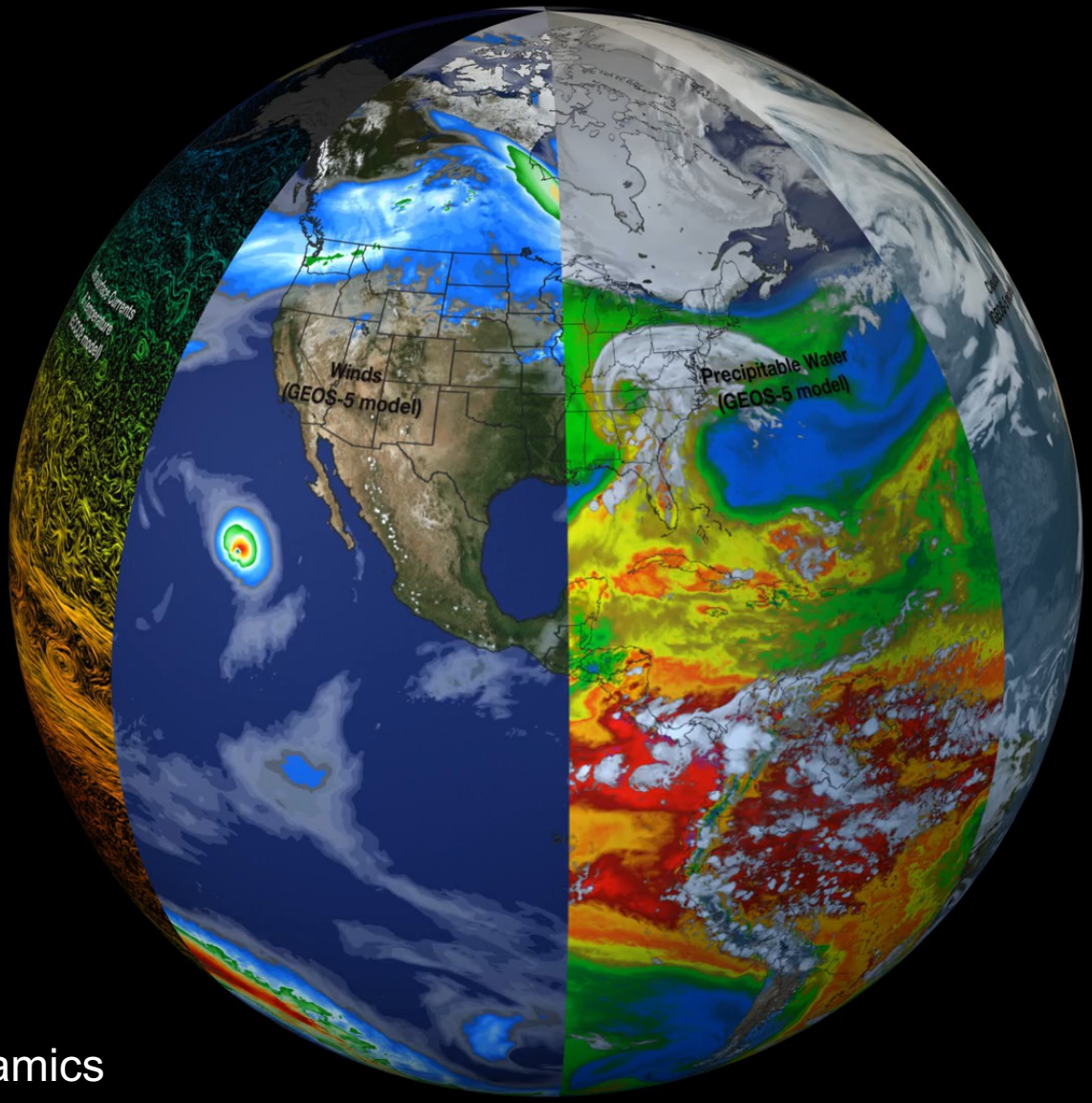
CLIMATE IS RAPIDLY CHANGING

Demand for accurate, timely, and actionable knowledge is more pressing than ever



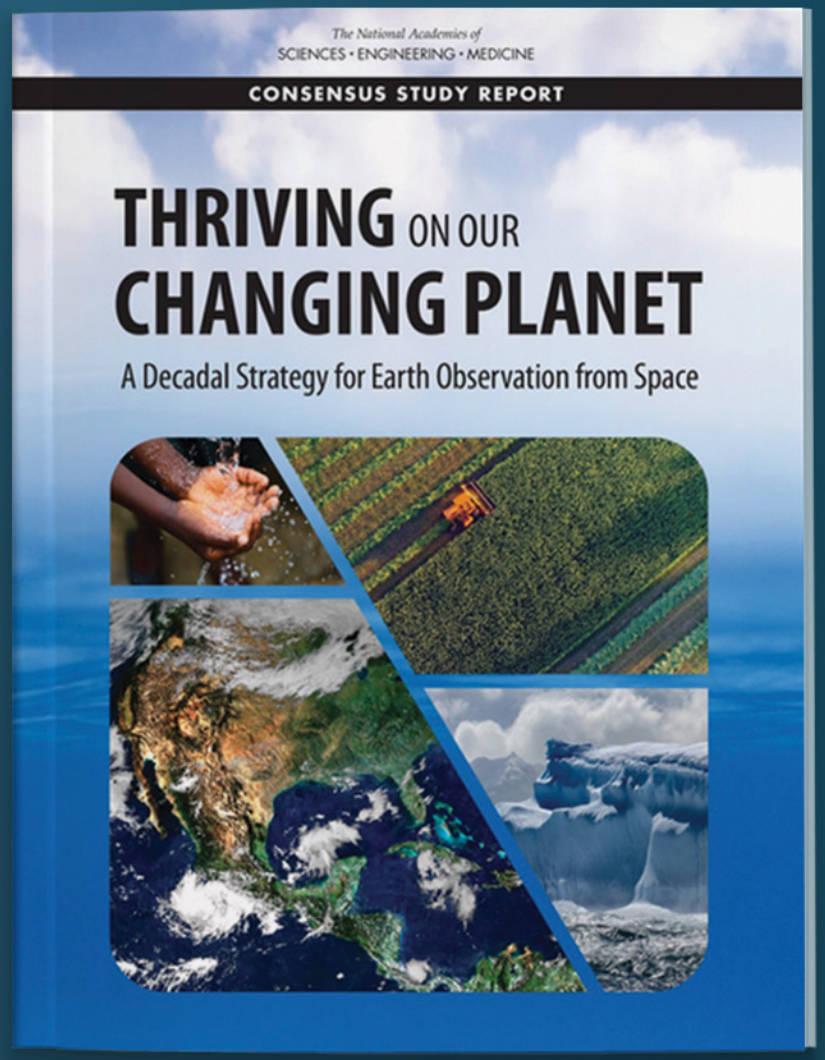
NASA Earth System Science



Atmospheric Composition
Carbon Cycle and Ecosystems
Climate Variability and Change
Earth Surface and Interior
Water and Energy Cycle
Weather and Atmospheric Dynamics

NASA Scientific Visualization Studio
svs.gsfc.nasa.gov/30701

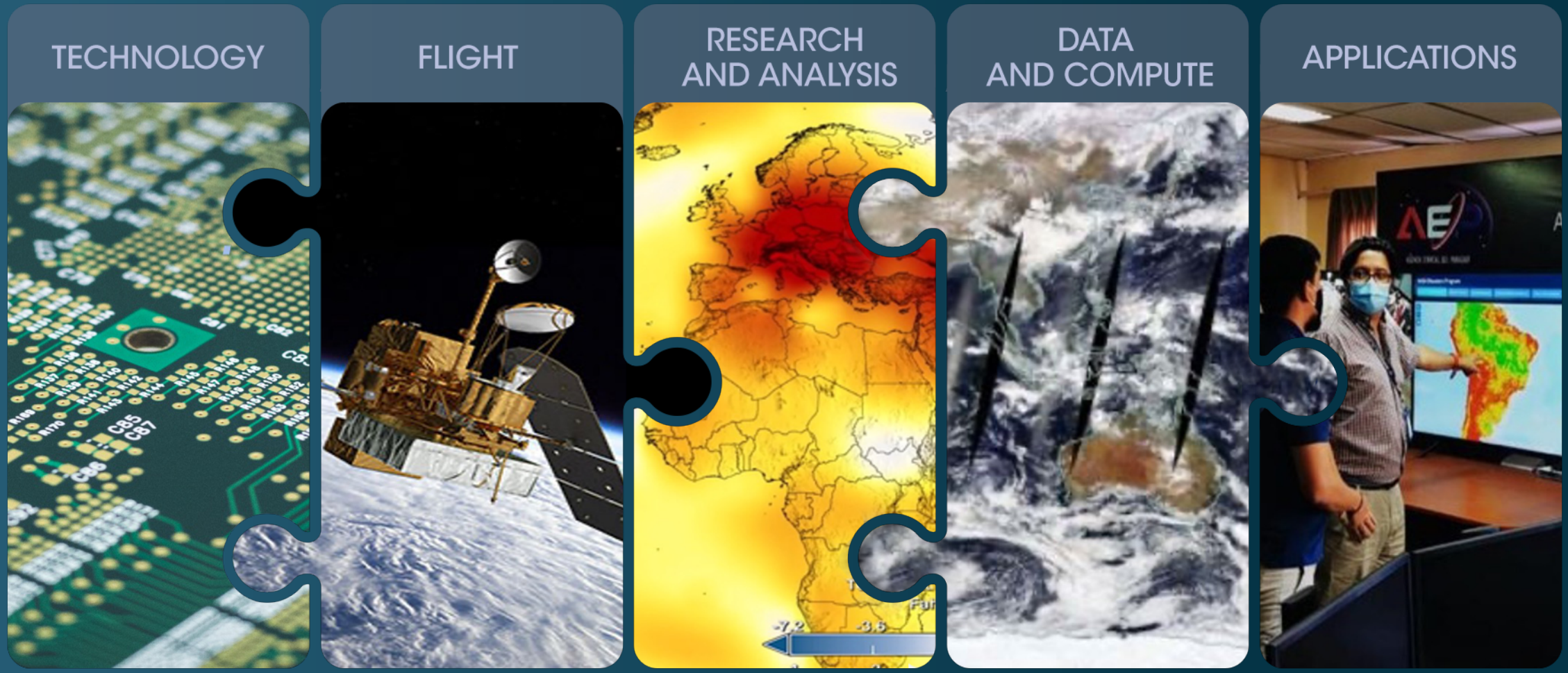
Earth System Science Informs Global and Regional Solutions



2017 Earth Science Decadal Survey

- A guiding framework for space-based Earth science
- Emphasizes partnerships and innovation
- Identifies key questions and observations for:
  - Climate variability and change
  - Weather and air quality
  - Hydrogeological cycles and water resources
  - Ecosystems and natural resource management
  - Solid Earth dynamics and hazards

Advancing Earth System Science End-to-end



NASA EARTH FLEET

OPERATING & FUTURE THROUGH 2023

SWOT (CNES)
LANDSAT-9 (USGS)
SENTINEL-6 B (ESA, EUMETSAT, NOAA)
TROPICS (6)
GEOCARB
NISAR (ISRO)
MAIA
TSIS-2
TEMPO
PREFIRE (2)
PACE (NSO)
GLIMR
SENTINEL-6 Michael Freilich (ESA, EUMETSAT, NOAA)
ICESAT-2
GRACE-FO (2) (GFZ)
CYGNSS (8)
NISTAR, EPIC (DSCOVR/NOAA)
CLOUDSAT (CSA)
TERRA (METI, CSA)
AQUA (JAXA, AEB)
AURA (NSO, FMI, UKSA)
CALIPSO (CNES)
GPM (JAXA)
LANDSAT 7 (USGS)
LANDSAT 8 (USGS)
OCO-2
SMAP
SUOMI NPP (NOAA)

ISS INSTRUMENTS

EMIT
CLARREO-PF
GEDI
OCO-3
TSIS-1
ECOSTRESS
LIS
SAGE III

JPSS-2, 3 & 4 INSTRUMENTS

OMPS-Limb
LIBERA

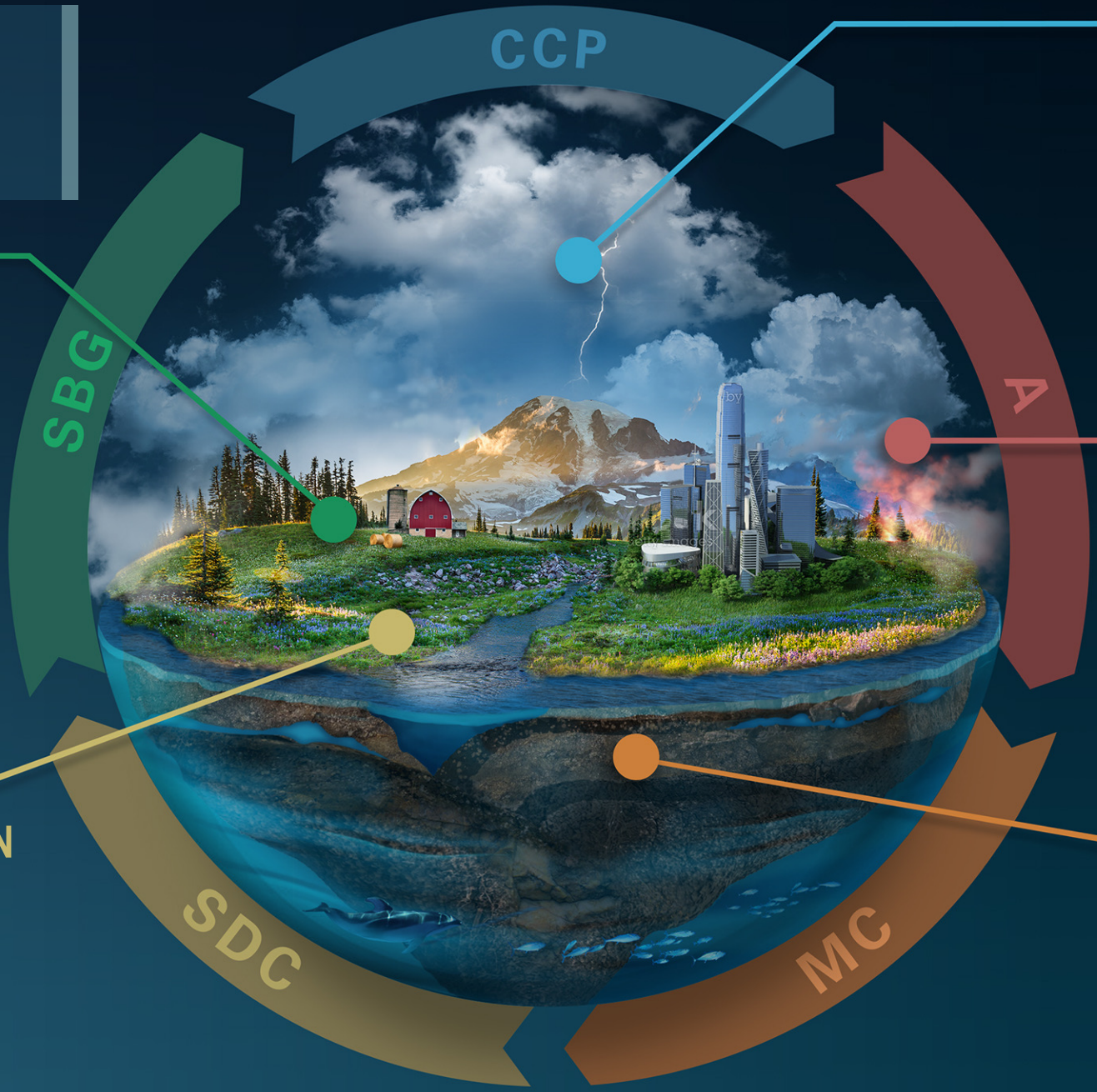
INVEST/CUBESATS

CSIM-FD
HARP
TEMPEST-D
CIRiS
CTIM
HyTI
SNoOPI
NACHOS

(PRE) FORMULATION
IMPLEMENTATON
PRIMARY OPS
EXTENDED OPS

03.26.2021

EARTH SYSTEM OBSERVATORY



CLOUDS, CONVECTION AND PRECIPITATION

Water and Energy in the Atmosphere

AEROSOLS

Particles in the Atmosphere

MASS CHANGE

Large-scale Mass Redistribution

SURFACE DEFORMATION AND CHANGE

Earth Surface Dynamics

SURFACE BIOLOGY AND GEOLOGY

Earth Surface & Ecosystems

INNOVATION & COMPETITION

Earth Explorer Missions

Greenhouse Gases

Ozone and Trace Gases

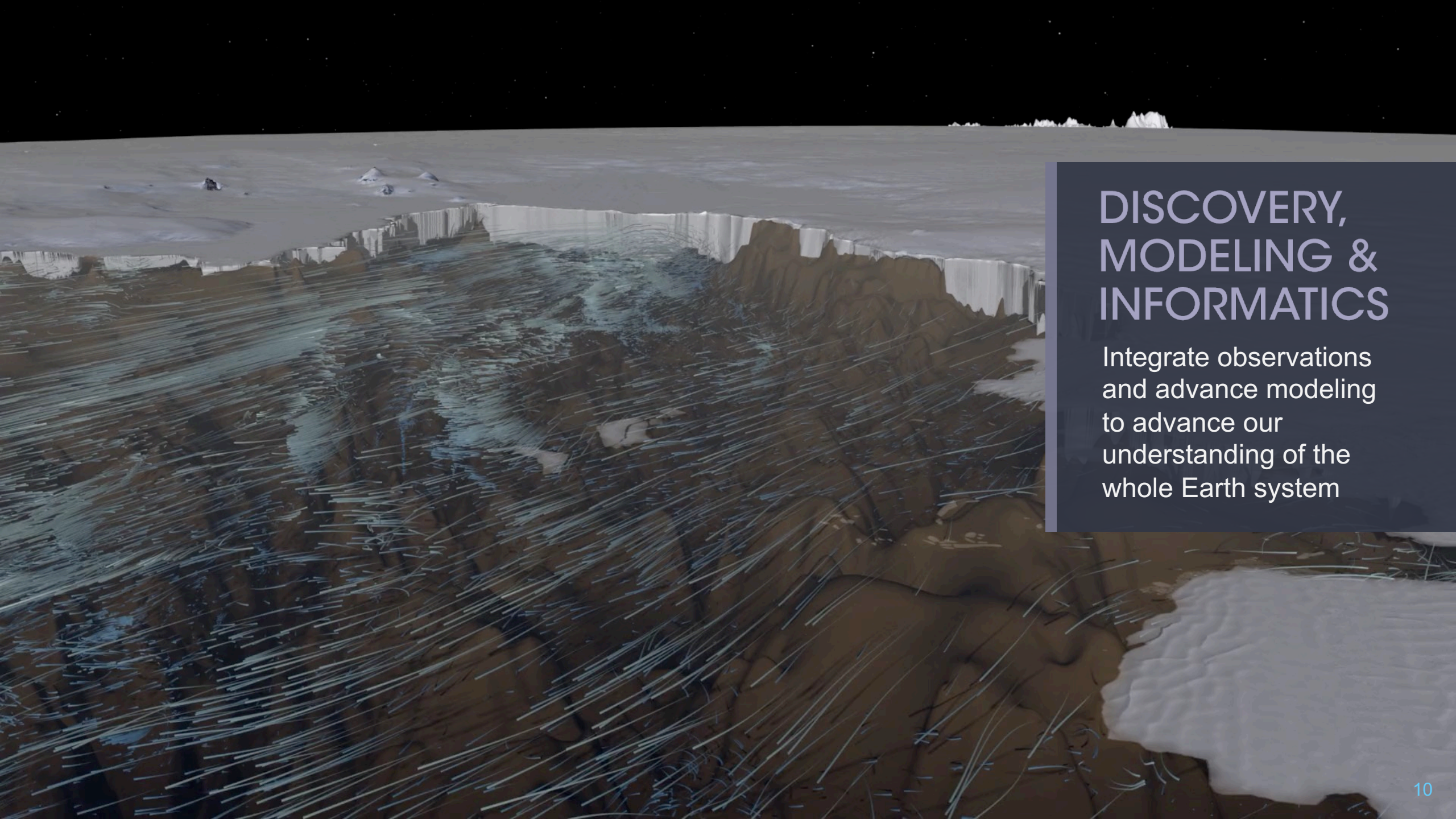
Atmospheric Winds

Ice Elevation

Snow Depth and Water Content

3D Ecosystem Structure

Ocean Surface Winds and Currents



DISCOVERY, MODELING & INFORMATICS

Integrate observations and advance modeling to advance our understanding of the whole Earth system

APPLICATIONS & DISSEMINATION

Accelerate the uptake of scientific understanding and deliver information in scalable ways

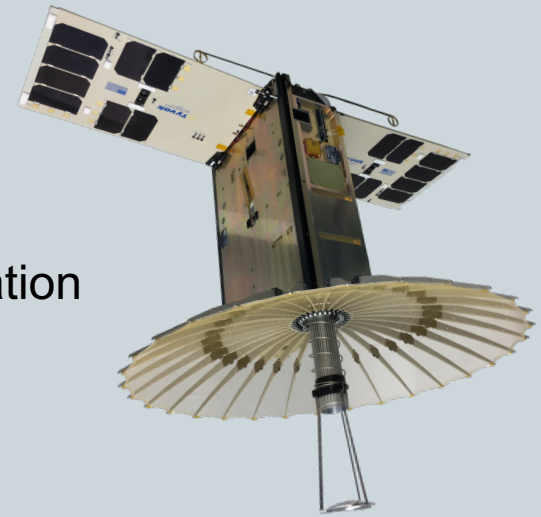
SDA CROPLANDS DATA LAYER
1997-2018—Field and Tree Crops

Urgency Demands Action and Innovation

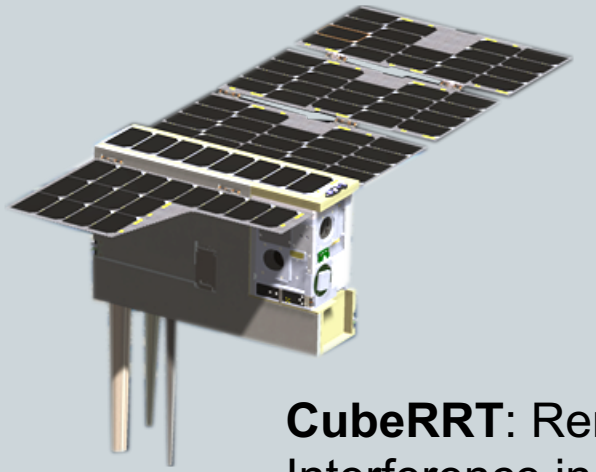
ADVANCING TECHNOLOGY INNOVATIONS FOR EARTH SCIENCE:

Two CubeSat missions successfully completed in 2020:

- Test and validate new space-based observing technologies
- CubeRRT demonstrated real-time RFI processing from space (reducing volume of data transmitted to ground)
- RainCube demonstrated first-use of radar on a CubeSat and validated Ka-band precipitation radar, and use of an ultra-compact, deployable antennae



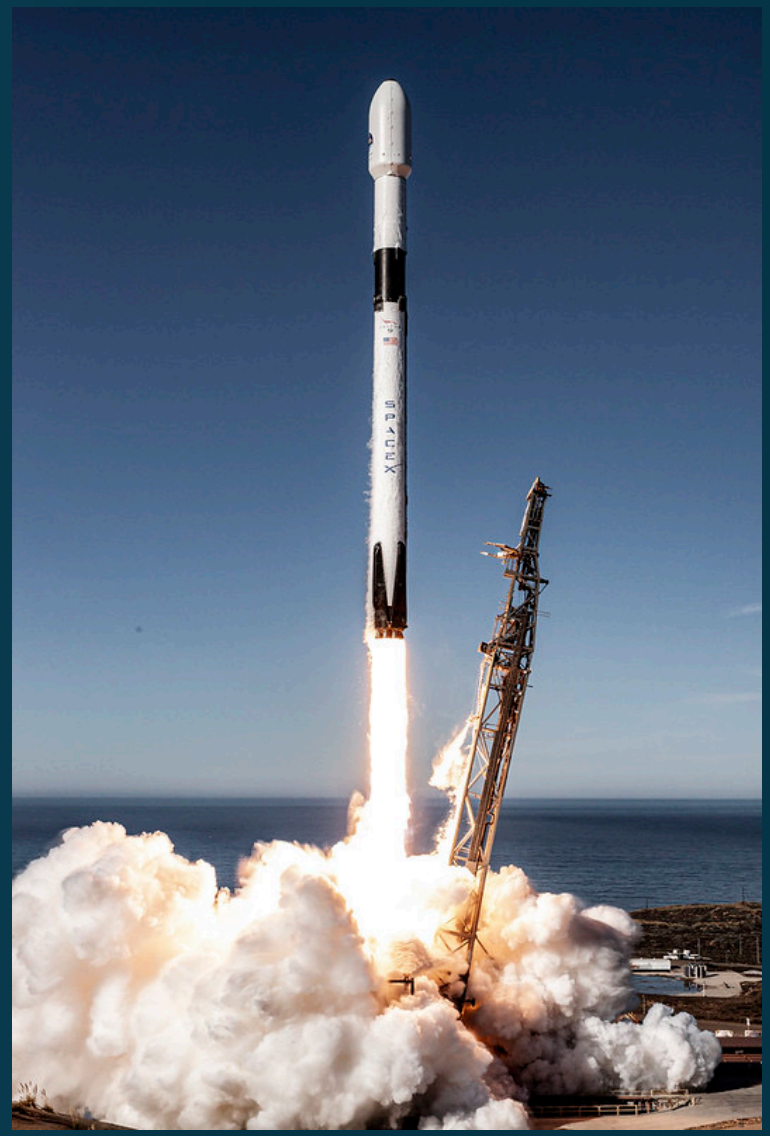
RainCube: Vertical Profiling of Precipitation



CubeRRT: Removing Interference in Radiometric Signals

Principles of Commercial Partnerships

- Strategic partnerships that leverage unique strengths to drive scientific progress
- Partnerships that innovate both in *what* we do with commercial partners and *how* we do it
- Evolving partnership models: experimentation is key and some experiments may fail
- Traditional and non-traditional partnerships for success in “enabling new science” and “more science per dollar”
- Leverage existing commercial capacity, demand, and expertise, while exploring emerging business areas
- Build on investments in partnerships across NASA and other parts of the government, sharing our own best practices



The SpaceX Falcon 9 rocket carrying the Sentinel-6 Michael Freilich spacecraft lifts off from Space Launch Complex 4 at Vandenberg Air Force Base in California, Nov. 21, 2020

Develop Open Science Ecosystem

Shorten the time it takes for a new user to find and learn how to use data

- Open access, availability, and discoverability of data

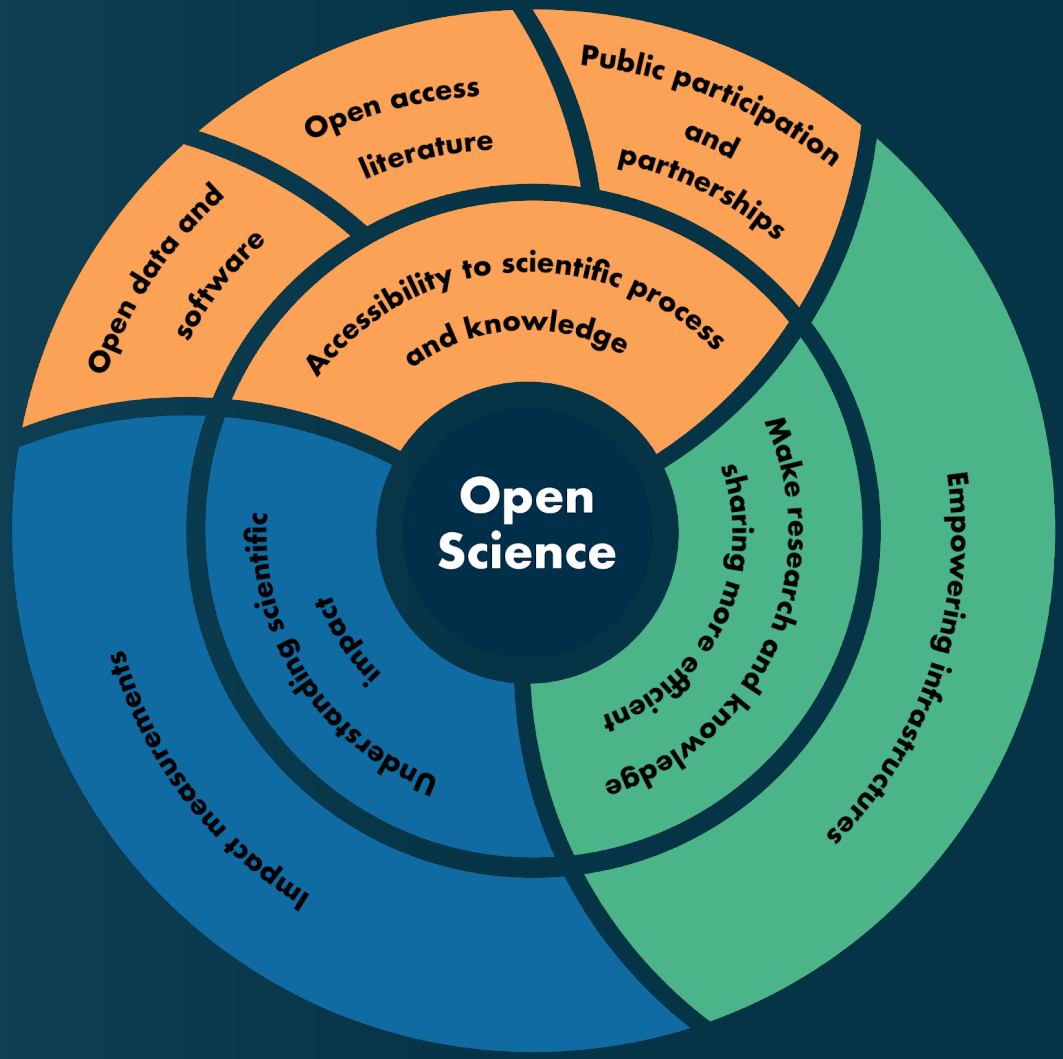
Increase the community of hands-on contributions

- Open access to and advancement of modeling and simulation code
- To improve models, assimilation, and prediction tools

Explore and exploit data in new ways

- Share knowledge and use current informatics and data science tools, in the same ecosystem as the data

Incentivize and energize innovation through prizes and challenges



ESD Priorities: Excellence in Earth Science

- ***Dramatically advance our understanding of the Earth system*** from vantage points of space, airborne and surface observations.

- ***Initiate the Earth System Observatory, NASA's next-gen advanced spaceborne systems***, to explore interactions between atmosphere, land, ocean, and ice processes that define climate change at regional and local levels, on near- to long-term time scales.

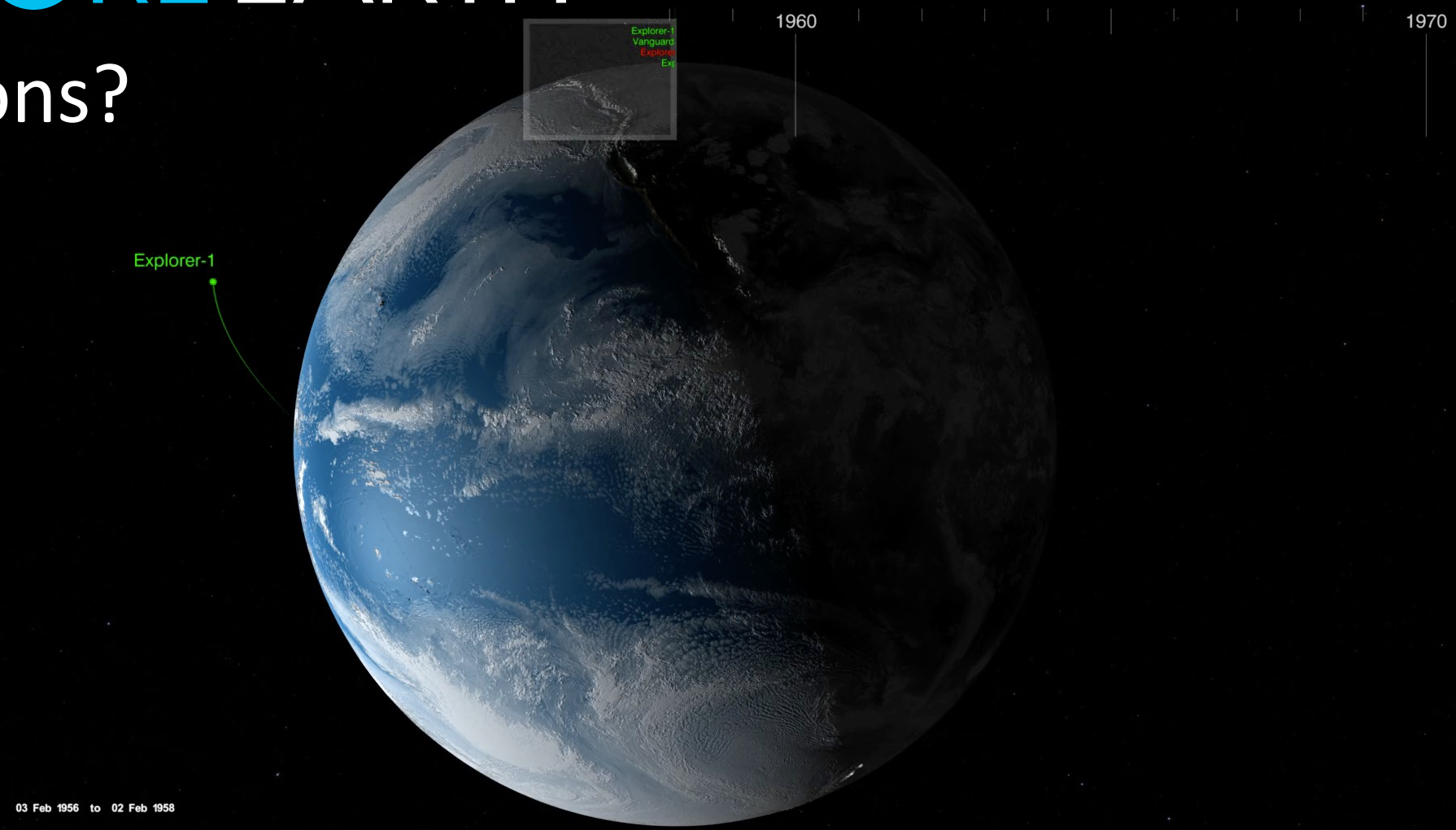
- ***Launch the competitive Earth Explorer program*** to rapidly develop innovative ways of observing additional key climate variables (greenhouse & trace gases, ice elevation & forest biomass), complementing the Observatory.

- ***Accelerate the pace of scientific discovery and its practical utility to decision-makers*** through Open Science principles and practices.

- Build a more ***prepared and capable workforce***, and ***meet the challenges of climate change in long-overlooked communities***, by expanding our Diversity and Inclusion efforts.

EXPLORE EARTH

Questions?



NASA Earth Observing Satellites Since 1958